

## **9.1 EXISTING PUBLIC FEATURES**

The existing physical infrastructure in the Acme WAU consists of two small communities (Acme and Van Zandt), private farms, residences, several cemeteries, a private railway line, the City of Bellingham aqueduct, an underground natural gas pipeline, electrical transmission lines, community fire hall, public buildings and numerous county roads and bridges (Table 9-1). Approximately seven miles of state highway 9 are located in the Acme WAU.

## **9.2 WATER SUPPLY ASSESSMENT**

Interviews with the Whatcom County Health Department and individuals familiar with the Acme area indicated that no surface water supplies are currently being used for municipal drinking water (Appendix 9-1, Forms H-1). A request for a search of the Department of Ecology Water Rights Information System (WRIS) dated 20 September 1994 revealed no municipal surface water rights registered. As no public water supplies are present in the WAU, further assessment of resource vulnerabilities for this module is not required.

The community of Van Zandt has no community water supply. The water supply source for the community of Acme is a groundwater well near a church adjacent to the South Fork Nooksack River (Figure 9-1). The water is treated with a chlorinator located near the wellhead. The water right for the Acme community well is dated 18 February 1993 and has an instantaneous use of 200 gallons per minute (well # 18). Former water supplies for Acme included a groundwater well and surface water reservoir. The well was adjacent to the Burlington Northern Railroad tracks near town and was contaminated by an underground petroleum supply. The water right for the former well was granted on 16 October 1989 and had an instantaneous volume of 100 gallons per minute. The water supply reservoir was located on a tributary of Jones Creek accessible from Turkington Road. This reservoir is not particularly well-sited and may be vulnerable to a mass wasting event.

A summary of the Department of Ecology Water Rights records dated 20 September 1994 indicated 46 active water rights recorded for surface water diversions in the Acme WAU (Table 9-2). All are for private uses. The primary nonconsumptive water right is for a small hydroelectric plant on Sygitowicz Creek. Seventeen surface water rights have been granted for private domestic drinking water supplies within the WAU. These provide for a total instantaneous usage of 300 gallons per minute. Nine of these water rights are provided from springs and the remainder are provided by creeks. The remaining surface water rights are for commercial use, irrigation or stock watering.

Table 9-1 Features located within the Acme WAU requiring a public works analysis.

INFRASTRUCTURE	LOW HAZARD AREAS	50-YEAR FLOOD PLAIN	100-YEAR FLOOD PLAIN	ALLUVIAL FAN HAZARD AREAS
Public roads	X	X	X	X
Private roads	X	X	X	X
Private railroad	X	X	X	X
Public Bridges	X	X	X	X
Private Bridges	X	X	X	X
Private Powerlines	X			
Private Pipelines (water)	X	X	X	X
Private Pipelines (gas)	X	X	X	X
Public Buildings	X			X
Private Buildings	X	X	X	X
Private Diversion weir				X

Table 9-2 Summary of surface water usage in the WAU.

---

<b>WATER USE</b>	<b>NO. OF USERS</b>	<b>ALLOCATION (cfs)</b>
Hydroelectric	1	6.99
Irrigation	20	6.42
Commercial	3	0.50
Domestic single	17	0.44
Domestic multiple	2	0.22

---

### **9.3 PUBLIC WORKS MODULE**

The public works assessment largely followed procedures outlined in the Manual (Washington Forest Practices Board 1994). However, the Acme watershed is somewhat unusual in two ways:

1. A large portion of the watershed is managed for purposes other than timber production, chiefly agriculture. Consequently, significant hazards threaten life and private property, as well as natural resources and public works.
2. Because most private property and public works occur on the valley floor, the primary natural hazards of concern are floods originating from the main fork or South Fork of the Nooksack River and debris events originating on the steep valley walls. Therefore, this presentation focusses on these natural hazards.

The public works structures located in the watershed are public buildings including a school and post office in Acme and a fire hall in Van Zandt, State Route 9, county roads (Caron, Hillside, Maleng, Mosquito Lake, Nelson, Potter, Rutsatz, Strand, Swamp, and Turkington Roads) and associated bridges and stream crossing structures (Table 9-3). Interviews with the Whatcom County Roads Department, Department of Transportation (DOT) personnel, and other public works officials, were used to determine if public works in the watershed were sensitive to changes in one or more of the three input variables, coarse sediment, peak flow and mass-wasting (Attachment 9-1, Forms H-3). Vulnerability ratings are summarized in Table 9-4.

#### **9.3.1 Low Vulnerability Areas**

Figure 9-1 indicates that areas at risk from flooding and debris events are located within or adjoining the valley of the South Fork. Areas not at risk are located chiefly on the valley walls or near the base of the Van Zandt Dyke, along the eastern edge of the valley floor. Public works within these low-risk areas include several bridges (B4, B17, B18 and B19 on Figure 9-1) and portions of State Highway 9 and several county roads. Private properties include numerous residences, private roads including logging roads on the valley walls, and several minor water diversions.

Public works in these areas are assigned by default a low vulnerability to peak flows, mass wasting and coarse sediment, except that bridges across streams are rated highly vulnerable to coarse sediment. Interviews with roads and transportation department personnel did not indicate that coarse sediment is a major concern for roads and bridges outside of the 100-year floodplain and located on the east side of the South Fork valley. Therefore the above-mentioned roads and bridges are given a low vulnerability to coarse sediment (Appendix 9-1, Form H-4).

Table 9-3 List of public works in the Acme WAU.

MAP ID	WORK	LOCATION	RISK <sup>1</sup>
B1	Bridge	State Route 9 at Nooksack River	F5
B2	Bridge	State Route 9 at Williams Lake Creek	F10
B3	Bridge	State Route 9 at Black Slough	F10
B4	Bridge	State Route 9 at Mosquito Lake Creek	F5
B5	Bridge	State Route 9 at Acme	F F5
B6	Bridge	Potter Road at South Fork	F5
B7	Bridge	Hillside Road at Falls Creek	F
B8	Bridge	Hillside Road at Terhorst Creek	F
B9	Bridge	Hillside Road at Sygitowicz Creek	F
B10	Bridge	Hillside Road at Hardscrabble Creek	F
B11	Bridge	Hillside Road at Radonski Creek	F
B12	Bridge	Turkington Road at McCarty Creek	F
B13	Bridge	Turkington Road at Jones Creek	F
B14	Bridge	Nelson Road at Black Slough	F10
B15	Bridge	Strand Road at Black Slough (W)	F10
B16	Bridge	Strand Road at Black Slough (E)	F10
B17	Bridge	Strand Road at Tinling Creek	None
B18	Bridge	Mosquito Lake Road at Mosquito Lake Creek (W)	None

<sup>1</sup> F = Presence of alluvial fan hazard.  
F5 = Presence in 50 year floodplain.  
F10 = Presence in 100 year floodplain.

Table 9-3 Continued

MAP ID	WORK	LOCATION	RISK
B19	Bridge	Mosquito Lake Road at Mosquito Lake Creek (E)	None
	Building	Acme School	F
	Building	Acme Post Office	F F10
	Building	Van Zandt Fire Hall	None
	Building	Van Zandt building 2	None
	Road	Highway 9	F F5 F10
	Road	Hillside Road	F
	Road	Turkington Road	F F10
	Road	Potter Road	F F5
	Road	Strand Road	F5 F10
	Road	Nelson Road	F10
	Road	Mosquito Lk Road	None
	Road	Caron Road	None

Table 9-4. Final public works vulnerability ratings for the Acme WAU.

INFRASTRUCTURE	COARSE SEDIMENT	PEAK FLOWS	MASS WASTING
Roads, bridges and structures not in 100 yr floodplain and not in alluvial fan hazard areas.	Low <sup>1</sup>	Low	Low
Roads, bridges, and structures in 100 yr and outside of 50 yr floodplain	High	Moderate	Low <sup>2</sup>
Roads, bridges, and structures in 50 yr floodplain	High	High	Low <sup>2</sup>
Roads, bridges, and structures in alluvial fan hazard areas	High	Low	High

<sup>1</sup> Represents a modification of vulnerability call: see Attachment 10-1, Form H-4 for details.

<sup>2</sup> Except in areas where floodplain coincides with alluvial fan hazard area, in which case vulnerability is "High."

### 9.3.2 Floodplain of the South Fork Nooksack River

The Federal Emergency Management Agency (FEMA) generates maps describing floodplains and both 50-year and 100-year flood levels for the United States. FEMA has produced a detailed study delineating these flood hazard areas adjoining the South Fork Nooksack within the Acme WAU (Figure 9-1). Within the floodplain of the main fork of the Nooksack, the FEMA study shows only a single flood event limit; this has been designated a 50 year floodplain in order to ensure conservative vulnerability ratings. Public works located within the 50 year floodplain include bridges over the main and South Fork of the Nooksack (B1, B5 and B6 in Figure 9-1) and adjacent portions of State Highway 9 and Potter Road, and portions of other county roads. Private works include a few residences and associated water diversions, a small part of the Burlington Northern railroad line, and the railroad bridges across the main and South Forks of the Nooksack. Within the 100 year floodplain, public works include approximately six miles of State Highway 9, parts of several county roads, five associated bridges over streams (B2, B3, B14, B15 and B16 in Figure 9-1), and a large part of the town of Acme including the Port Office and the well that provides the municipal water supply. Private works include numerous residences and associated water diversions, and most of the railroad line and associated bridges.

The manual rates bridges over streams and roads within the floodplain as vulnerable to peak flow events. The distinction between moderate and high vulnerability is determined by location in a 50 year (high) or 100 year (moderate) floodplain. Interviews with Whatcom County Road Department and Department of Transportation (DOT) staff confirmed this level of vulnerability. County roads which have experienced recent flooding include Potter Road in 1989 or 1990 and Strand Road west of state highway 9, both of which lie within the 50 year floodplain. The portion of Rutsatz road in the floodplain is being undercut by the Nooksack River during peak flow events.

The manual rates floodplain roads and bridges over streams as highly vulnerable to coarse sediment. Interviews with Lewis County Engineering Department and Whatcom County Road Department confirm this vulnerability call for roads and bridges on floodplains within the WAU.

Some portions of the floodplain are also vulnerable to mass wasting associated with debris events on alluvial fans. This hazard is treated below.

### 9.3.3 Alluvial Fan Hazard Area

Streams draining the western slopes of the WAU have formed alluvial fans where they flow out onto the flat valley floor. Study of these fans reveals that they have formed by the deposition of large quantities of coarse sediment; in fact, nearly every stream from Falls Creek in the north to Jones Creek in the south has experienced several debris events (debris flows, dambreak floods, or related landslide/flood processes) since 1960 (Whatcom County Planning Department 1992). Because such events



typically consist of a fast-moving slurry of sediment and woody debris, they pose a hazard due to both mass wasting and coarse sediment. Many of these events have destroyed bridges or culverts. Debris events may also cause a stream to leave its channel and form a new channel; some such events have destroyed roads and buildings. For example, a debris event on Sygitowicz Creek in December 1979 destroyed several private buildings and vehicles. Another debris event on Jones Creek in 1983 damaged Turkington Road and the associated bridge and flowed into the town of Acme.

Debris events on alluvial fans deposited from Falls Creek south to McCarty Creek pose a hazard to Hillside and Turkington Roads and associated bridges (B7, B8, B9, B10, B11 and B12 on Figure 10-1). Private works at risk include the hydropower facility on Sygitowicz Creek, several surface water diversions, and 26 homes. Debris events on the Jones Creek fan place at risk all public and private facilities in the town of Acme, including a school, state highway 9 and the associated bridge over the South Fork, a store, and a large number of houses.

Interviews with the Whatcom County Road Department and Department of Transportation (DOT) staff indicated that bridges and roadways in this area are vulnerable to peak flow events, coarse sediment inputs and mass wasting. The Jones Creek bridge at Turkington Road was cited as a source of historical coarse sediment deposition and recent flooding, as were recent problems with mass wasting along Hillside Road. A report by the Whatcom County Planning Department (1992) details the history of debris events in the area and notes the extensive damage done to roads, bridges and private property by events in 1979, 1983 and 1990. Therefore public works in alluvial fan hazard areas are rated highly vulnerable to coarse sediment and mass wasting. In spite of repeated flood events on alluvial fans, the area is not regarded as at risk due to peak flows *per se*. Floods only occur on these alluvial fans when the stream channel has been filled by a debris event; at such times, streamflow is necessarily diverted over the streambank. Such floods are therefore due to coarse sediment deposition.

#### **9.4 WATER QUALITY**

Although a water supply assessment is not a required portion of the module, available water quality data will be included as background information. EPA STORET water quality data include data collected from two stations near the community of Van Zandt on 10 December 1976. In addition to the EPA data, water quality data was collected during August and September 1994 in support of baseline water quality monitoring by Beak Consultants Inc (Table 9-5). Water quality parameters collected during 1976 and 1994 included pH, temperature, conductivity and dissolved oxygen. The surface water can be described as neutral to slightly basic with moderate to high conductivity and high dissolved oxygen.

#### 9.4.1 Water Temperature Gaging

The mainstem Nooksack and South Fork Nooksack Rivers in the Acme WAU are classified as Class A (excellent) by the Department of Ecology surface water standards. Class A water quality standards require that temperature not exceed 18.0 degrees Celsius (64.4 degrees Fahrenheit) due to human activities. When natural conditions exceed 18.0 degrees Celsius, no temperature increases will be allowed which raise the receiving waters by more than 0.3 degrees Celsius (WAC 173-201A-030).

Six temperature gaging stations were installed in the Acme WAU on 4 August 1994. The gages were located in selected Type 1 and Type 3 surface waters that were accessible and flowing. The temperature gages included four maximum temperature gaging locations and two continuous recording temperature locations. The continuous recording gages were supplemented by maximum recording thermometers which provided quality assurance and contingency data in the event of theft or vandalism of the continuous gages. The continuous recorders gathered data at thirty minute intervals. Elevations ranged from approximately 225 feet to 480 feet (Table 9-5). The gages were removed on 27 September 1994.

The continuous recording thermometers were installed at the inflow to the Acme WAU on the mainstem near the community of Welcome, and the inflow to the Acme WAU on the South Fork Nooksack at the Saxon bridge. The other maximum recording stations included the outflow from the mainstem above the confluence with the South Fork Nooksack and three tributaries feeding to the South Fork on the western portion of the WAU. The tributary stations included McCarty Creek and Sygitowitz Creek and one unnamed tributary.

Water quality data was collected at each station during gage installation and retrieval. Parameters collected included water temperature, pH, dissolved oxygen and conductivity (Table 9-5). Field notes and photographs document each sampling station.

Quality assurance/quality control measures employed included calibration of thermometers, in situ calibration of water quality instruments, analytical laboratory results to verify accuracy of field equipment and chain of custody forms to track laboratory samples. The continuous recorders are manufactured by Onset Instruments in Pocasset, MA with an accuracy of +/-0.4 degrees Celsius.

#### 9.4.2 Results

The maximum water temperature of the mainstem Nooksack decreased from the inflow station (ACM0194 @ 18 °C) to the outflow station (ACM0294 @17 °C) (Table 9-5). Continuous temperature monitoring data (station ACM0194) indicate that at no time did water temperature exceed the Class A water quality standard of 18 degrees

Table 9-5 Summary of water quality data collected by Beak Consultants for the Acme WAU.

STATION/ ELEVATION (feet)	WATER BODY	DATES	pH	CONDUCTIVITY ( $\mu$ mho/cm <sup>2</sup> )	DISSOLVED OXYGEN (mg/l) / %	MEAN TEMP. (Celsius)	MAXIMUM TEMP. (Celsius)
ACM0194	Nooksack	4 Aug	7.77	100	NA	17.6	
285	RM 40.8	27 Sep	6.79	99	10.6 / 103%	12.4	18 / 18*
ACM0294	Nooksack	4 Aug	7.64	80	NA	17.5	
225	RM 36.6	27 Sep	7.48	99	10.4 / 104%	13.9	17
ACM0394	Falls	4 Aug	7.47	100	NA	18.4	
320		27 Sep	7.03	110	8.6 / 90%	15.8	21
ACM0494	Sygitowicz	4 Aug	7.62	69	NA	18.7	
475		27 Sep	7.37	71	13.1 / 130%	13.3	17
ACM0594	McCarty	4 Aug	7.36	68	NA	16.6	
380		27 Sep	7.28	69	9.0 / 90%	13.9	17.5
ACM0694	South Fork	4 Aug	7.71	110	NA	20.6	
315	RM 12.9	27 Sep	7.65	130	8.5 / 86%	14.7	21.5 / 20.1*
Range	minimum		6.79	68	8.5	12.4	17
	maximum		7.77	130	13.9	20.6	21.5

Water quality monitoring was conducted during gage installation and removal. Dissolved oxygen and pH values were collected in situ. These parameters may change throughout the day, and no effort was made to ensure that sample collection occurred at the same time of day. Dissolved oxygen was collected using a YSI model 51B DO meter, calibrated onsite the day of sampling. PH values were collected using a Hanna model 9024 pH meter, calibrated onsite the day of sampling. Conductivity was analyzed by AmTest Laboratories in Redmond, Washington. Maximum temperature values marked with an asterisk represent data from continuous gages.

Celsius. The South Fork Nooksack at the inflow to the Acme had the highest maximum temperature recorded during monitoring (ACM0694 @21.5 °C).

Temperatures at this continuous monitoring station (Figure Y) exceeded the Class A water quality standard for a total of 150.5 hours. Sygitowicz Creek and McCarty Creek met the Class A water quality standard for temperature (stations ACM0494 @17 °C and ACM0594 @ 17.5 °C). Falls Creek (ACM0394 @ 21 °C) did not meet the temperature standard.

## **9.5 CONFIDENCE LEVEL**

Confidence is high that public works and water supplies have been accurately assessed. Recent aerial photographs (1991) were available for the assessment. Public works personnel contacted for interviews were familiar with the area and provided detailed specific information. The analyst has worked on other modules in this analysis, is familiar with watershed history, and has conducted several days of onsite investigations. Data from the channel condition and surface erosion modules were incorporated in the evaluation of alluvial fan hazard areas, and a detailed recent report (Whatcom County Planning Department 1992) provided invaluable further detail on alluvial fan hazards.

## REFERENCES

- Adkinson, Ann. Whatcom County Department of Health. Telephone interview to complete Form H-1 (Water supply assessment interview) on 12 September 1994. (206) 676 6724.
- Department of Ecology. Water Rights search requested for the Acme and Canyon Lake WAUs on 15 September 1994. Fax: (206) 407 7163.
- Federal Emergency Management Administration (FEMA) Flood Insurance Study for the unincorporated areas of Whatcom County Washington and Floodplain Boundary and Floodway Maps. Available through the FEMA office at 130 228th Avenue, Bothell, Washington. (206) 481-8800.
- Goshorn, Stan. Supervisor, Washington State Department of Transportation for Whatcom County. Telephone and facsimile correspondence on 20 September and 3 November 1994 to complete Form H-3. (206) 676 2100.
- McCort, Bill. City of Bellingham Public Works. Telephone interview to complete Form H-1 on 12 September 1994. (206) 676 6850.
- McKinnen, Laura. Whatcom County Engineering Department. Telephone interview and facsimile correspondence to complete Form H-3 on 12 September 1994. (206) 676 6558.
- Scott, Gordon. Whatcom County Planning Department. Telephone interview and facsimile correspondence 20 September and 2 November 1994 to complete Form H-3 and delivery of the Whatcom County Critical Areas Study. (206) 676 6756.
- Silvas, Clayton. Supervisor, Whatcom County Road Department. Telephone interview with Tom Shugrue (Beak) to complete form H-3 (Public works assessment interview). 7 September 1994. (206) 676-6759
- U.S. E.P.A. Request for STORET water quality data for the Acme and Canyon Lake WAUs requested 12 September 1994. (206) 553-1200
- Washington Administrative Code. 1993. WAC 173-201A-030 General water use and criteria classification; Item 2, B, IV.
- Washington Administrative Code. 1993. WAC 173-201A-130 Specific classifications -Freshwater; Items 71 and 73.
- Whatcom County Planning Department. 1992. Alluvial fan hazard areas. Whatcom County Environmental Resources Series, Bellingham.
-

## APPENDIX 9-1

**Form H-4: Public works assessment  
Modification of Vulnerability Call**

Public work: Bridges not in 50-year and 100-year floodplains  
o high alluvial fan hazard areas r

Input Variable: Coarse sediment

Vulnerability Assigned by Table H-4: High

Modified Vulnerability Rating: Low

**Basis for Modification:**

Interviews with roads and transportation department personnel did not indicate that coarse sediment is a major concern for bridges outside of the 100-year floodplain and located on the east side of the South Fork valley.